

The Vinegar Eelworm

J. B. MacGowan

Vinegar eelworms, Turbatrix aceti (Muller, 1783) v. aceti Peters 1927, have been subjects of curiosity and scientific study for hundreds of years (6,9,14). They are small nematodes, 1-2 mm long, marginally visible to the naked eye, and have been associated with the vinegar industry around the world. They have been reported to leave the vinegar and form a "thick white slime of innumerable eelworms" on the vat walls just above the vinegar surface (9,10,11). Gerald Thorne, who was one of the early leaders in nematology in the United States, reported that, as a boy, he recalled that they imparted "a very special and pleasing flavor" to the family's vinegar (14). The vinegar eelworm was the subject of the first published scientific record of any free-living nematode. In 1656 (87 years before the first publication of a plant parasitic nematode by Turbeville Needham in 1743), Petrus Borellus published a short note titled "De Vermibus aceti" in his Observationum Microscopiarum Centuria (11,14). He recorded that he could discern worms in the neck of a vinegar flask and believed they sought the surface of the liquid in order to breathe (11). During the years that followed, vinegar eelworms became subjects of study by early investigators pioneering the science of microscopy, including Linnaeus and Leeuwenhoek (11,14). Controversy arose in the 18th Century as to whether the worms which could be found in bookbinders' paste were the same as those which people were observing in their vinegar. In 1767, Linnaeus had proposed the name Chaos redivivum for both forms (9). The controversy remained unresolved for the next 143 years until J. G. DeMann, in 1910, published a lengthy account of the vinegar eelworm and T. Goodey, in 1922, published an account of the paste eelworm (9). Goodey's publication showed that the paste eelworm was morphologically distinct from the vinegar eelworm.

Turbatrix aceti lives its entire life cycle in vinegar or other suitable fluids, and feeds on bacteria. The nematodes usually congregate near the upper surface of the vinegar and are constantly in motion (6). Males and females are present in equal numbers and although the size of the adults can vary according to the culture medium, they are generally reported to be 1-2 mm long (10,11). The fertilized eggs mature and hatch in approximately 8 days and the emerging larvae become sexually mature in about 4 weeks (10).

Although these nematodes are reported to be killed by temperatures of 37-45 C (98.6-113 F), they can tolerate temperatures as low as -77 C (-106.6 F), and survive solidification in both liquid air and liquid nitrogen (5,6,7,8,11). Among the toxic substances in which they are capable of living are 2% potassium dichromate, saturated tannic acid, strychnine (18 hrs.), 1% chromic acid, and leather tanning liquor (11,12). Vinegar eelworms can be cultured in a variety of different media such as cider vinegar, 4% sugar in water, flour paste, and fruits. It is reported that they can be grown in 15% ethyl alcohol (11,13).

Because of their short life cycle, ease of handling, and ease of culture, vinegar eelworms have been used extensively as models for biological research. They are easily maintained in axenic culture; i.e., they grow well and propagate in the absence of other life forms. Embryological studies have shown that nematodes provide the clearest and best documented examples of germinal lineage in the animal kingdom, and T. aceti has been one of the most intensely studied animals for this purpose (2,3). These nematodes have been used by investigators for studies on radiation, aging, reproduction and senescence, nutritional research, respiration and energy metabolism, growth, chemical composition, morphology, patterns of locomotion, toxicity studies, nerve muscle relationships, and neurophysiological research (1,2,4,15, 16,17).

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